DOCUMENT RESUME

ED 411 259 TM 027 202

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TITLE Direct and Indirect Tests of Internal/External Frames of Reference Model with Measures of Academic Self-Efficacy.
PUB DATE 1996-04-00
NOTE 15p.; Paper presented at the Annual Meeting of the American Educational Research Association (New York, NY, April 8-12, 1996).
PUB TYPE Reports - Research (143) -- Speeches/Meeting Papers (150)
EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Academic Achievement; Comparative Analysis; Correlation; High School Students; High Schools; Mathematical Aptitude; *Problem Solving; *Self Efficacy; Self Evaluation (Individuals); *Student Attitudes; Verbal Ability
IDENTIFIERS *Academic Self Concept; *Internal External Frame of Reference Model; Los Angeles City Schools CA

ABSTRACT

The internal/external (I/E) frames of reference model proposed by H. Marsh (1986, 1990) points to the relativistic nature of academic self-concept formation. It argues that students compare their own academic ability to that of their peers in an external comparison, and they compare their own verbal skills to their mathematics skills in an internal comparison. The relative superiority of one set of skills over the other becomes salient in this comparison, yielding a negative correlation between verbal and mathematics self-concept. This study tested the I/E model with typical measures of academic self-efficacy with 588 students from 4 Los Angeles (California) high schools. Students rated their confidence in their ability to solve problems and their perceptions of ability in each school subject. Overall, results do not provide clear support for the I/E model. Even when students were explicitly told to compare their capability in one domain to that in the others, their verbal and mathematics self-perception failed to exhibit a negative relationship. It is difficult to accept the I/E model's contention that students spontaneously, if not voluntarily, undergo two separate comparison processes when asked to report their own perceived competence. It appears that their perceptions of capability are constructed without the internal comparison process. (Contains three figures and nine references.) (SLD)

Running Head: I/E FRAMES OF REFERENCE MODEL WITH SELF-EFFICACY

Direct and Indirect Tests of Internal/External Frames of Reference Model With Measures of Academic Self-Efficacy

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Poster session presented at the annual meeting of the American Educational Research Association, New York, NY, April, 1996.

The internal/external (I/E) frames of reference model proposed by Marsh (1986, 1990) points to the relativistic nature of academic self-concept formation. He argues that students compare their academic ability to that of their peers in what he termed an external comparison. Since verbal and math achievement are usually highly correlated, this is likely to result in a positive correlation between verbal and math self-concept. In an internal comparison, students compare their own verbal skills to their own math skills. The relative superiority of one set of skills over the other becomes salient in this comparison, yielding a negative correlation between verbal and math self-concept. High verbal (math) achievement, therefore, exerts a negative influence on math (verbal) self-concept.

When the two processes operate simultaneously, a positive correlation between verbal and math self-concept from an external comparison cancels out a negative correlation from an internal comparison or vice versa. Depending on the relative contribution of the two comparison processes, the correlation between verbal and math self-concept remains positive or negative, but almost always in significantly reduced magnitude than that between verbal and math achievement (see, for example, Byrne & Shavelson, 1986; Marsh, Byrne, Shavelson, 1988; Marsh & Shavelson, 1985).

Skaalvik and Rankin (1990), however, tested predictions derived from the I/E model with cognitive measures of self-concept and found no support for the model. Verbal and math self-concept were substantially correlated in their study. Moreover, math achievement did not bear a direct negative effect on verbal self-concept. A significant direct negative effect of verbal achievement on math self-concept was found for girls but not for boys. The authors concluded that the formation of verbal and math self-concept was independent of the internal comparison, denying one of the two relativistic ability

judgment processes suggested by Marsh (1986, 1990). A more recent study by Skaalvik and Rankin (1995) reported that I/E model's predictions were confirmed with the general measures of self-perception but not with the specific measures which closely resembled academic self-efficacy.

Marsh, Walker, and Debus (1991) claimed that effects of frames of reference on self-efficacy should be minimized because perceptions of efficacy, unlike self-concept, were more likely to be formed in relation to a specific performance criterion. Many efficacy researchers also assume that people arrive at their self-efficacy estimations primarily based on an absolute standard of success and failure (e.g., Zimmerman & Martinez-Pons, 1990). Predictions from the I/E model, therefore, are not expected to be upheld when self-efficacy measures are employed.

Interestingly, neither Marsh's nor Skaalvik's series of studies asked students about their self-concept or self-efficacy in direct reference to the I/E frames. They did not test directly whether students' verbal and math self constructed in relation to their ability in the opposite domain are indeed negatively correlated. Nor did they test directly whether their verbal and math self initiated in comparison to their peers actually demonstrate a positive relationship. All the existing evidence for the I/E model comes from the presence of negative paths from verbal and math achievement to the self-perceptions in the opposite area and of the near-zero correlation between verbal and math self-concept, which supposedly confirms the hypothesized internal and external comparison processes in operation.

The present study tested predictions of the I/E model with typical measures of academic self-efficacy. More important, it directly examined the hypothesized relationship

between verbal and math self perceptions resulted from internal and external comparison processes. It asked the question whether the relationship of students' self-perceived ability in one domain to that in the other differs according to the frames of reference provided.

Method and Procedures

588 students from 4 high schools in the greater Los Angeles area participated in the study. Six school subjects were selected for measuring their academic self-efficacy: English, Spanish, US history, algebra, geometry, and chemistry. English, Spanish, and US history were considered verbal subjects while algebra, geometry, and chemistry were included as math-related subjects. Seven representative problems for each school subject were presented to the students through an overhead projector. Students rated their confidence that they would be able to solve each problem correctly on a scale ranging from 0 to 100 in 10-unit intervals.

Students were then asked to rate their ability perceptions in each school subject as well as in verbal and math subjects in general on a Likert type scale ranging from 1 to 7, both in reference to their ability in the other area (i.e., internal comparison; e.g., "Compared to my ability to learn math subjects, my ability to learn verbal subjects is ...") and in reference to their peers (i.e., external comparison; e.g., "Compared to my friends and classmates, my ability to learn verbal subjects is ..."). Students also reported their grade in each school subject which was used as an achievement index.

Results and Discussion

Academic self-efficacy scales for six school subjects as well as the internal and external self-perception of ability scales all displayed high reliability. The standardized coefficient α ranged between .81 and .97.

Indirect Test of I/E Model

To test one of the I/E models' predictions that academic achievement in one area exerts negative influence on self-perceptions of ability in the other, Marsh's model used in previous studies (e.g., Marsh, 1986) was replicated with self-efficacy measures. There was an important difference in the present study's model from the previous ones, however. Specifically, verbal and math self-efficacy were posited as second-order factors, each of which is presumed to underlie student's efficacy perceptions in verbal and math-related school subjects. English, Spanish, and US history 1st-order self-efficacy factors were loaded on verbal 2nd-order self-efficacy factor, while algebra, geometry, and chemistry 1st-order self-efficacy factors were loaded on math 2nd-order self-efficacy factor. A CFA model with the second-order verbal and math self-efficacy displayed an acceptable fit (χ^2 = 715.65, $\underline{df}$ = 128; Bentler-Bonnett normed fit index = .93, nonnormed = .93; comparative fit index = .94; all parameters with $\underline{p}$'s < .05).

A final structural model consisted of six 1st-order self-efficacy factors (i.e., English, Spanish, US history, algebra, geometry, chemistry), two 2nd-order self-efficacy factors (i.e., verbal and math), and two achievement factors (i.e., verbal and math) with three indicators for each 1st-order latent factor. All paths from verbal and math achievement to the 2nd-order verbal and math self-efficacy were estimated. The model fit was improved by adding two error and disturbance covariances (χ^2 = 964.16, $\underline{df}$ = 238;

Bentler-Bonnett normed fit index = .92, nonnormed = .93; comparative fit index = .94; all factor loadings with ps < .05).

Surprisingly, a path linking verbal achievement to verbal self-efficacy was non-significant (p > .05). Math achievement exerted a significant positive influence on verbal self-efficacy (standardized γ = .46). Math self-efficacy was positively influenced by math achievement (standardized γ = 1.02) but negatively affected by verbal achievement (standardized γ = -.42). Therefore, the I/E model's claim was supported only for math self-efficacy.

Direct Test of I/E Model

More interesting results were obtained with measures of self-perceived ability in direct reference to the internal and external comparison frames. First, a simple CFA model was specified with verbal and math perceived ability factors constructed from internal and external comparison processes (hereafter referred to as internal verbal, internal math, external verbal, and external math) to test the I/E model's predictions concerning the relationships among them. Specifically, internal verbal and internal math should demonstrate a negative relationship whereas external verbal and external math should exhibit a positive one. Each of the four latent factors were specified by four indicators (Internal verbal factor, for example, was defined by internal English, internal Spanish, internal US history, and internal verbal subjects scale).

A final CFA model with 8 error covariances (i.e., between internal and external self-efficacy for each school subject) fit the data well (χ^2 = 369.70, df = 90; Bentler-Bonnett normed fit index = .94, nonnormed = .94; comparative fit index = .95; all parameters with ps < .05). Internal verbal and internal math were highly correlated with

external verbal and external math, respectively (standardized ϕ = .85 for verbal and .90 for math). Consistent with the I/E models' prediction, external verbal was positively correlated with external math (standardized ϕ = .37). Internal verbal and internal math, however, were also positively related to each other (standardized ϕ = .20), contradicting the I/E model's prediction.

An extended model that included verbal and math achievement factors was fitted to the data to further test the predictions of the I/E model. A final model with 12 error covariances was specified (χ^2 = 707.74, df = 182; Bentler-Bonnett normed fit index = .91, nonnormed = .91; comparative fit index = .93; all factor loadings with ps < .05). It was found that verbal achievement positively influenced both internal and external verbal (standardized γ = .79 and .72, respectively) and negatively influenced both internal and external math (standardized γ = -.26 and -.23, respectively). Math achievement bore a positive impact on both internal and external math (standardized γ = .86 and .84, respectively). It negatively influenced internal verbal (standardized γ = -.26) but did not exert a significant impact on external verbal (standardized γ = -.14, p > .05). Verbal and math achievement were positively correlated (standardized ϕ = .63).

Overall, the results do not provide clear support for the I/E model. Most striking evidence against the I/E models' prediction comes from a set of relationships between verbal and math self-perception of ability. Even when the students were explicitly told to compare their capability in one domain to that in the others, their verbal and math self-perception so created failed to exhibit a negative relationship. In fact, they were still

positively correlated with each other, although the magnitude of their relationship was somewhat reduced than that obtained from the external comparison.

Given the findings of the present study, it is difficult to accept the I/E model's contention that students spontaneously, if not voluntarily, undergo two separate comparison processes when asked to report their own perceived competence. At least with academic self-efficacy measures, it appears that students' perception of capability is constructed without the internal comparison process, which might be just one of many differences between self-concept and self-efficacy.

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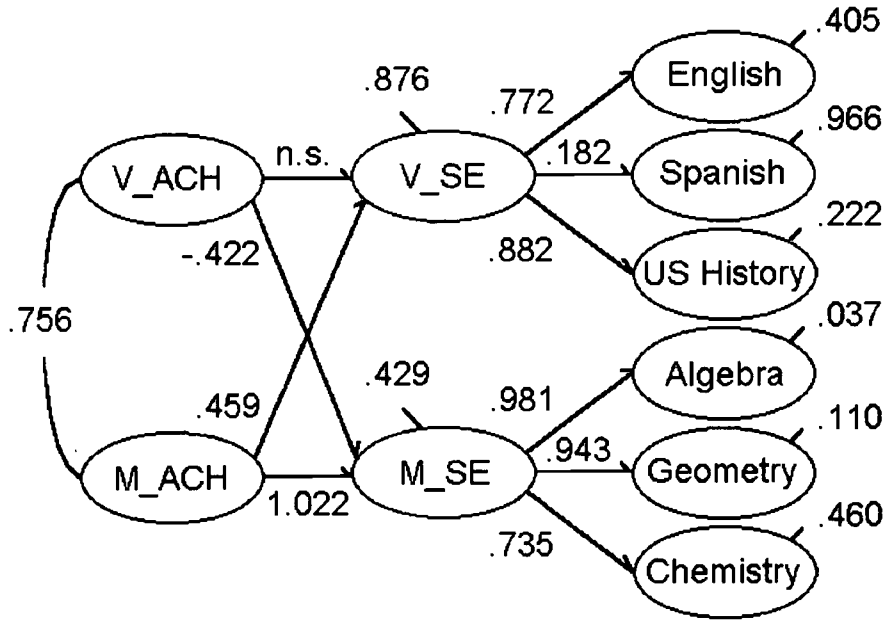
Figure Captions

Figure 1. A second-order I/E frames of reference model with problem-level academic self-efficacy. V_ACH = verbal Achievement; M_ACH = math Achievement; V_SE = verbal academic self-efficacy; M_SE = math academic self-efficacy. Covariances among error and disturbance terms are deleted from presentation for clarity.

Figure 2. A CFA model of academic self-efficacy formulated in direct reference to I/E comparison frames. Int/Verbal = internally referenced verbal academic self-efficacy; Int/Math = internally referenced math academic self-efficacy; Ext/Verbal = externally referenced verbal academic self-efficacy; External/Math = externally referenced math academic self-efficacy. Variances and covariances of error terms are deleted from presentation for clarity.

Figure 3. A second-order I/E frames of reference model with academic self-efficacy formulated in direct reference to I/E comparison frames. VerbalACH = verbal achievement; MathACH = math achievement; Int/VSE = internally referenced verbal academic self-efficacy; Int/MSE = internally referenced math academic self-efficacy; Ext/VSE = externally referenced verbal academic self-efficacy; External/MSE = externally referenced math academic self-efficacy. Covariances among error and disturbance terms are deleted from presentation for clarity.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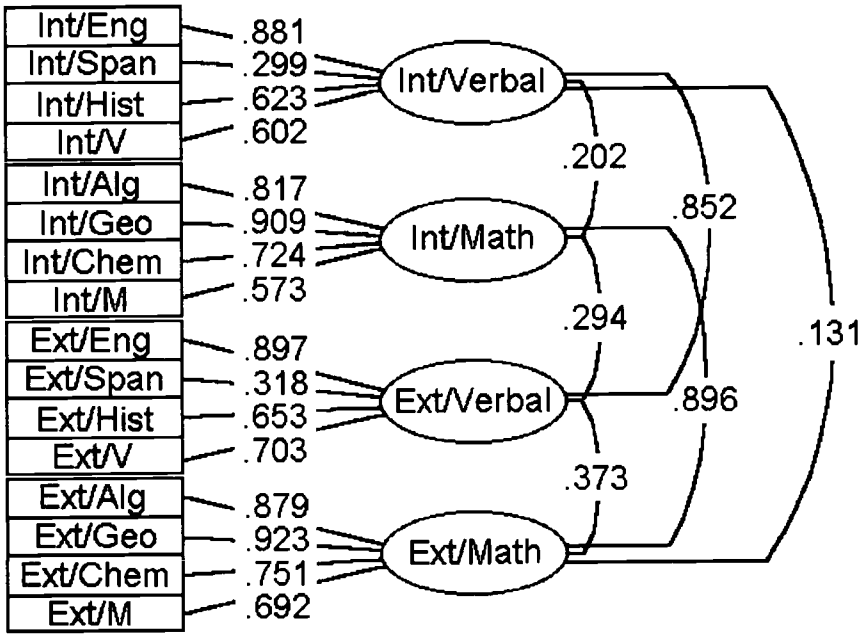
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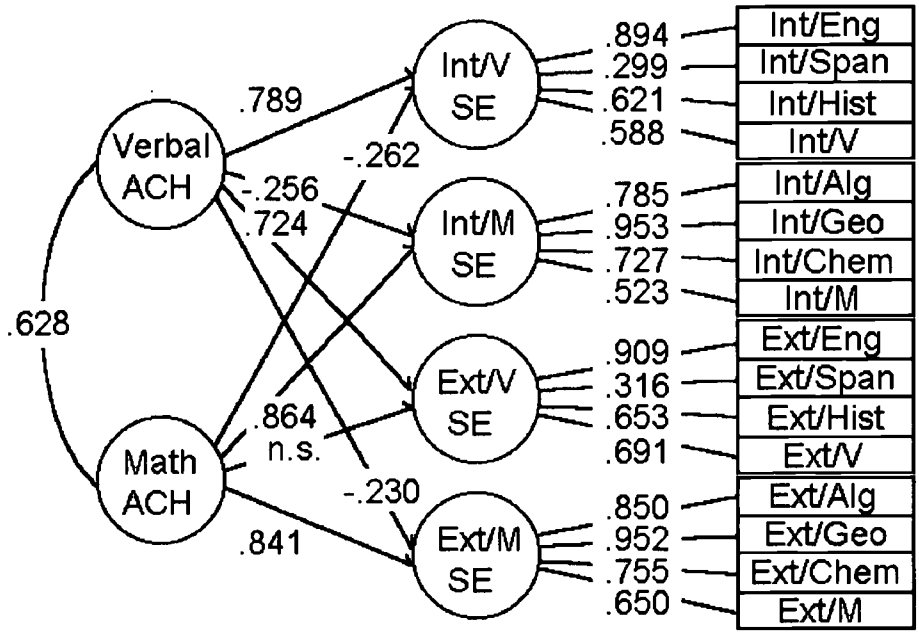
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